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<p>(21) International Application Number: <b>PCT/US93/12490</b> (22) International Filing Date: <b>20 December 1993 (20.12.93)</b> (30) Priority Data: <b>07/992,780</b>      <b>18 December 1992 (18.12.92)</b>      <b>US</b>  (71) Applicant: <b>CAPITOL VIAL, INC. [US/US]; 42 Union Street, P.O. Box 446, Fultonville, NY 12072 (US).</b> (72) Inventors: <b>ABRAMS, Robert, S.; 21 Marion Avenue, Albany, NY 12203 (US). SUPRANOWICZ, Ronald, P.; 38 Hawthorne Street, Lenox, MA 01240 (US).</b> (74) Agent: <b>REYNOLDS, David, D.; Burns, Doane, Swecker &amp; Mathis, Washington and Prince Streets, P.O. Box 1404, Alexandria, VA 22313-1404 (US).</b></p>		<p>(81) Designated States: <b>AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</b></p> <p><b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: <b>A RESEASABLE CAP</b></p> <div data-bbox="373 1134 1193 1743"></div>		

(57) Abstract

A releasable cap (12) includes an inner cap surface and an inner peripheral wall, and a seal for forming a seal between the cap (12) and an upper edge of a rim of a structure (10). The seal extends from the inner cap surface and is arranged concentric with respect to the inner peripheral wall so as to form a gap (18) between the outer edge and the inner peripheral wall for receiving the upper edge of the rim. A flange (14) integrally connects the cap to the structure (10) wherein the flange is formed from a flexible material so as to permit bending of the flange so that the cap (12) can move from a first position wherein it is seated on the structure to a second position wherein it is not seated on the structure.

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## A RESEALABLE CAP

### Field of the Invention

The present invention relates to sealing structures for pour spouts and vials; and more particularly to a seal and method for releasably sealing a cap onto a structure such as a pour spout or vial.

### Background of the Invention

5 Resealable caps are well known in the art. Such caps may be used on gabled top containers and brick type containers. See Figures 11 and 12, respectively, of U.S. Patent No. 5,108,029. In addition, caps of a similar style have been used to seal vials of different sizes and shapes. See, for example, Figure 4 of U.S. Patent  
10 No. 4,783,056. Such caps are convenient because they form a liquid-tight seal and can be repeatedly opened and closed easily.

For purposes of convenience, such caps are frequently integrally connected to the structure that they are intended to seal. For example, they may be connected by a flexible flange that allows the cap to pivot from an opened position to a sealed  
15 position.

In order to enhance the seal between the cap and the structure or container onto which the cap is fastened, an annular seal may be provided within the cap in order to form an annular gap between the seal and the outer rim of the cap. The annular gap is designed to receive an upper edge of the container onto which the cap  
20 is sealed. In order to obtain a good, liquid-tight seal between the container and the cap, it is preferable that the upper edge of the container wall fit tightly within the annular gap. However, fitting the upper edge of the container wall tightly within the annular gap creates difficulties. Specifically, if the cap is not properly aligned with the container immediately prior to closing, the upper edge of the container wall  
25 may improperly contact the annular seal or outer rim of the cap, thus bending or damaging the seal, the outer rim of the cap, or the upper edge of the container wall.

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In addition, if the annular gap is too narrow, the upper edge of the container wall may not fit properly within the gap, thus also creating problems with the seal.

Caps of the type to which the present invention relates are generally injection molded from plastic.

5

#### Summary of the Disclosure

In view of the foregoing disadvantages, it is an object of the present invention to provide a recloseable cap that may be used with either vials or spouts for liquid containers, which cap includes an improved seal.

10 One embodiment of the resealable cap of the present invention includes an inner cap surface and an inner peripheral wall, and further includes a seal for forming a seal between the cap and an upper edge of a rim of a structure to which the cap is to be sealed, wherein the structure may be a vial, a spout for a container, or any suitable device. The seal extends from the inner cap surface and is arranged  
15 concentric with respect to the inner peripheral wall so as to form a gap between the outer edge of the seal and the inner peripheral wall for receiving the upper edge of the rim.

Both the inner edge and the outer edge of the seal extend toward the inner cap surface at an angle between 30 and 60 degrees, preferably 45 degrees.

20 A flange integrally connects the cap to the structure, wherein the flange is formed from a flexible material so as to permit bending of the flange so that the cap can move from a first position wherein it is seated on the structure to a second position wherein it is not seated on the structure. The flange includes means for weakening the flange at a first portion in order to encourage bending of the flange at  
25 the first portion and means adjacent to the weakening means for stiffening the flange at a second portion to minimize bending of said flange at the second portion. The stiffening means also provides additional stability when the cap is being removed from the mold.

30 The inner peripheral wall of the cap also includes a first section and a second section, wherein the first section opposes the outer edge of the seal to form the gap.

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The first section is substantially the same height as the seal means, and extends substantially perpendicular to the inner cap surface.

#### Brief Description of the Drawings

5        Figure 1 is a cross-sectional view of a known vial and cap.

Figure 2 is a cross-sectional view of a cap connected to a vial with a flange constructed according to the present invention.

Figure 3 is a perspective view of a known gabled top container having a pour spout mounted thereon.

10       Figure 4 is a cross-sectional view of a spout and cap according to the present invention.

Figure 5 is an enlarged view of a portion of Figure 4.

Figure 6 is a cross-sectional view of a vial and cap according to the present invention.

15       Figure 7 is an enlarged view of a portion of Figure 6.

#### Detailed Description of the Preferred Embodiments

With reference to Figure 1, a known vial and cap arrangement is disclosed. Specifically the vial and cap illustrated in Figure 1 is disclosed in U.S. Patent No. 20 4,783,056, which issued on November 8, 1988. According to the known arrangement, a vial 10 is connected to a cap 12 by means of a flange 14. An annular seal 16 is provided on the inside of the cap 12 in order to define a corresponding annular gap 18. The annular gap 18 is designed to accommodate the upper edge 20 of the vial 10.

25       A recess 22 is formed in the flange 14 to facilitate the bending of the flange 14 during the process of transferring the cap 12 to the top of the vial 10. Specifically, the recess 22 is intended to weaken the flange 14 at a particular point so that bending of the flange 14 is encouraged in the region of the recess 22. By attempting to direct the bending of the flange 14, alignment of the upper edge 20 of 30 the vial wall with the annular gap 18 is facilitated. Such alignment, of course,

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reduces the number of incidents where the tip of the annular seal 16 abuts directly against the upper edge 20 of the vial wall thus damaging either the annular seal 16 or the upper edge 20 of the wall. Such damage would reduce the effectiveness of the seal between the cap and the vial.

5           The subject matter of U.S. Patent No. 4,783,056 is hereby incorporated herein by reference.

          However, it has been found that the recess 22 in the flange 14 does not always adequately guide the cap 12 onto the vial. To further facilitate the bending of the flange 14 so that the cap 12 accurately aligns itself on the edge 20 of the wall  
10 of the vial 10, the flange 14 has been further modified.

          Turning attention now to Figure 2, an improved version of the flange is illustrated. A flange 114 interconnects a vial 110 with a cap 112. A recess 122 is provided in the flange 114 to facilitate bending of the flange at a particular location. In addition to the recess 122, an elongated ridge 124 extends across most of the  
15 flange 114. The ridge 124 is preferably parallel to the recess 122 and preferably extends perpendicularly across the flange 114. The ridge 124 stiffens a portion of the flange 114 adjacent the recess 122. The combination of the ridge 124 and the recess 122 functions so as to more precisely direct the bending of the flange 114 to ensure proper alignment of the cap 112 on the edge 120 of the wall of the vial 110  
20 when the cap is being moved to seal the vial. The improved alignment of the cap with the end wall of the vial minimizes the number of occurrences in which the seal 116 of the cap improperly contacts the upper edge 120 of the vial wall so as to damage either the cap or the vial wall. As a result, the performance of the seal of the cap to the vial is greatly improved.

25           The ridge 124 further functions so as to engage with a shoulder in the mold in which the vial and cap are formed. By engaging the shoulder of the mold, the ridge 124 prevents the flange 114 from slipping in the mold because of buckling of the vial. Thus, the ridge 124 helps to ensure that the cap 112 aligns properly on the vial 110.

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Turning attention to Figure 3, it can be seen that the type of cap and flange arrangement used with the vial of Figure 2, can also be used with a spout arrangement for a gabled top container. The subject matter of U.S. Patent 5,108,029 and pending U.S. application serial no. 07/07/753,855 is hereby  
5 incorporated herein by reference.

An enlarged view of a spout and cap for use with such a gable top container is illustrated in Figure 4. A spout 210 includes a lower end 226 that fits within the container and retains the spout in place on the container. The cap 212 includes an annular seal 216 that forms an annular gap 218 between the seal 216 and the outer  
10 peripheral wall 228 of the cap. The annular gap 218 is designed to accommodate the upper edge 220 of the spout 210.

The spout 210 is integrally attached to the cap 212 by a flange 214. The flange 214 includes a recess 222 and an elongated ridge 224 to direct the bending of the flange 214 to a preferred location. As set forth above with respect to the  
15 embodiment shown in Figure 2, the recess 222 provides a weak region in the flange 214 while the ridge 224 provides a strengthened region. The recess 222 and the ridge 224 coact so as to ensure the proper alignment of the cap 212 on the upper edge 220 of the spout 210.

Other improvements have been made to the cap to ensure optimum sealing  
20 with the upper edge of the wall of the structure onto which the cap is seated. The portion of the cap illustrated in Figure 4 that is identified by circle 5 is enlarged and illustrated more clearly in Figure 5. As illustrated in Figure 5, both the shape of the annular seal 216 and the inner peripheral wall 228 of the rim 230 of the cap 212 have been modified.

25 Specifically, with respect to the seal 216, the upper edge 236 of the seal has been truncated to a flat surface. In addition, the inner edge 232 of the seal 216 has been changed from substantially normal to the inner surface 238 of the cap to a surface that intersects the inner cap surface 238 at an angle of approximately 45°. Similarly, the outer edge 234 of the seal 216 is similarly angled with respect to the  
30 inner cap surface 238. The angle formed by the outer edge 234 may be between

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30° and 60°, but is preferably 45°. At the base of the seal 216, the outer edge 234 includes a very small portion 240 that extends perpendicularly to the inner cap surface 238. In the preferred embodiment, the small portion 240 extends for only about 0.003 inches.

5 In addition, the height to width ratio of the seal 216 has been changed. The improved seal 216 preferably has a height of approximately 0.018 inches and a width of approximately 0.041 inches. Thus, the width of the seal is at least twice the height of the seal in the preferred embodiment. However, it should be understood that not only the specific height and width of the seal may vary, but also  
10 the ratio of the height to width may vary.

The inner peripheral wall 228 has also been modified to improve the seal. The wall 228 now includes a first section 246 that is normal to the inner cap surface 238 and extends for approximately 0.017 inches. A second section 244 continues from the first section at an angle of approximately 26°. The second section 244  
15 ends at a distance of approximately .040 inches from the inner cap surface 238. Thus, the tip 236 of the seal 216 ends at approximately the same height as the end of the first section 246 of the wall 228.

Because of the angle of the second wall section 244, a third wall section 242 extends out from the first wall section 246 by a distance of approximately 0.011  
20 inches. A fourth wall section 248 extends away from the third wall section at an angle of approximately 31°.

A result of the configuration of the wall sections is that there is a protruding ridge extending from the inner peripheral wall 228 of the rim 230. The protruding ridge coacts with the annular seal 216 to control the movement of the upper edge  
25 220 of the spout 210 when the cap 212 is being sealed onto the spout 210. When the upper edge 220 is sealed within the cap 212, the edge contacts the cap 212 at three different points: (1) along the first wall section 246, (2) along the second wall section 244, and (3) at the outer wall 234 of the seal 216. The three point contact helps to assure a fluid-tight seal. Of course, the upper edge 220 may  
30 contact the cap 212 at other locations in addition to the three points listed above.



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Although the modifications to the cap 212 have been illustrated on a cap that is fixed to a container spout, the same principles apply equally to a cap for use with a vial of the type illustrated in Figure 2. Figures 6 and 7 illustrate such a vial and cap.

5       The cap 312 includes an annular seal 316 that forms an annular gap 318 between the seal 316 and the outer peripheral wall 328 of the cap. The annular gap 318 is designed to accommodate the upper edge 320 of the vial 310.

10       The vial 310 is integrally attached to the cap 312 by a flange 314. The flange 314 includes a recess 322 and an elongated ridge 324 to direct the bending of the flange 314 to a preferred location. As set forth above with respect to the embodiment shown in Figure 2, the recess 322 provides a weak region in the flange 314 while the ridge 324 provides a strengthened region. The recess 322 and the ridge 324 coact so as to ensure the proper alignment of the cap 312 on the upper edge 320 of the vial 310.

15       The portion of the cap 312 illustrated in Figure 6 that is identified by circle 7 is enlarged and illustrated more clearly in Figure 7.

20       Specifically, with respect to the seal 316, the upper edge 336 of the seal has been truncated to a flat surface. In addition, the inner edge 332 of the seal 316 intersects the inner cap surface 338 at an angle of approximately 45°. Similarly, the outer edge 334 of the seal 316 is similarly angled with respect to the inner cap surface 338. The angle formed by the outer edge 334 may be between 30° and 60°, but is preferably 45°. At the base of the seal 316, the outer edge 334 includes a very small portion 340 that extends perpendicularly to the inner cap surface 338. In the preferred embodiment, the small portion 340 extends for only about 0.003 inches.

25       The improved seal 316 preferably has a height of approximately 0.018 inches and a width of approximately 0.041 inches. Thus, the width of the seal is at least twice the height of the seal in the preferred embodiment. However, it should be understood that not only the specific height and width of the seal may vary, but also the ratio of the height to width may vary.

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The inner peripheral wall 328 includes a first section 346 that is normal to the inner cap surface 338 and extends for approximately 0.017 inches. A second section 344 continues from the first section at an angle of approximately 26°. The second section 344 ends at a distance of approximately .040 inches from the inner  
5 cap surface 338. Thus, the tip 336 of the seal 316 ends at approximately the same height as the end of the first section 346 of the wall 328.

Because of the angle of the second wall section 344, a third wall section 342 extends out from the first wall section 346 by a distance of approximately 0.011 inches. A fourth wall section 348 (Figure 6) extends away from the third wall  
10 section 342 at an angle of approximately 31°.

A result of the configuration of the wall sections is that there is a protruding ridge extending from the inner peripheral wall 328 of the rim 330. The protruding ridge coacts with the annular seal 316 to control the movement of the upper edge 320 of the vial 310 when the cap 312 is being sealed onto the vial 310. When the  
15 upper edge 320 is sealed within the cap 312, the edge contacts the cap 312 at three difference points: (1) along the first wall section 346, (2) along the second wall section 344, and (3) at the outer wall 334 of the seal 316. The three point contact helps to assure a fluid-tight seal. Of course, the upper edge 320 may contact the cap 312 at other locations in addition to the three points listed above.

20 Although only preferred embodiments are specifically illustrated and described herein, it will be appreciated that many modifications and variations of the present invention are possible in light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

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What we claim is:

1. A seal arrangement for sealing a resealable cap having an inner cap surface and an inner peripheral wall onto a rim having an upper edge, comprising:
  - 5 an annular seal extending from the inner cap surface;  
said annular seal including an inner edge and an outer edge;  
said annular seal arranged concentric with respect to said inner peripheral wall so as to form a gap between said outer edge of said seal and said inner peripheral wall for receiving the upper edge of the rim;
  - 10 the outer edge of said seal extends toward the inner cap surface at an angle between 30 and 60 degrees.
2. The seal arrangement of claim 1, wherein the angle is approximately 45  
15 degrees.
3. The seal arrangement of claim 2, wherein the inner edge of the seal extends  
20 towards the inner cap surface at an angle of approximately 45 degrees.
4. The seal arrangement of claim 1, wherein the annular seal includes a  
truncated top surface.
- 25 5. The seal arrangement of claim 1, wherein the inner peripheral wall includes a first section that opposes the outer edge of the seal to form the gap, said first section is substantially the same height as the seal and extends substantially perpendicular to the inner cap surface.

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- 10 -

6. The seal arrangement of claim 5, wherein the inner peripheral wall includes a second section that is adjacent the first section, said section forms a ridge that protrudes from the first section for contacting the upper edge of the rim when the cap is sealed to the rim.

5

7. A seal arrangement for sealing a resealable cap having an inner cap surface and an inner peripheral wall onto a rim having an upper edge, comprising:

an annular seal extending from the inner cap surface;

10 said annular seal including an inner edge and an outer edge;

said annular seal arranged concentric with respect to said inner peripheral wall so as to form a gap between said outer edge of said seal and said inner peripheral wall for receiving the upper edge of the rim;

said inner peripheral wall including a first section and a second section,

15 said first section opposes the outer edge of the seal to form the gap,

said first section is substantially the same height as the seal, and

said first section extends substantially perpendicular to the inner cap surface.

20

8. The seal arrangement of claim 7, wherein the second section of the inner peripheral wall is adjacent the first section, and said second section forms a ridge that protrudes from the first section for contacting the upper edge of the rim when the cap is sealed to the rim.

25

9. The seal arrangement of claim 7, wherein the outer edge of the seal extends towards the inner cap surface at an angle of approximately 45 degrees.

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10. The seal arrangement of claim 9, wherein the inner edge of the seal extends towards the inner cap surface at an angle of approximately 45 degrees.

5 11. The seal arrangement of claim 10, wherein the annular seal includes a truncated top surface.

12. A resealable cap having an inner cap surface and an inner peripheral wall,  
10 comprising:

means for forming a seal between the cap and an upper edge of a rim of a structure to which the cap is to be sealed, said seal forming means extending from the inner cap surface;

said seal forming means including an inner edge and an outer edge;

15 said seal forming means arranged concentric with respect to said inner peripheral wall so as to form a gap between said outer edge and said inner peripheral wall for receiving the upper edge of the rim;

both the inner edge and the outer edge of said seal forming means extend toward the inner cap surface at an angle between 30 and 60 degrees;

20 said inner peripheral wall including a first section and a second section,

said first section opposes the outer edge of the seal forming means to form the gap,

said first section is substantially the same height as the seal forming means, and

25 said first section extends substantially perpendicular to the inner cap surface.

13. The cap of claim 12, wherein the structure is one of a vial and a spout for a  
30 container.

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14. The cap of claim 12, wherein the angle is approximately 45 degrees.

15. The cap of claim 12, wherein the annular seal includes a truncated top  
5 surface.

16. A resealable cap having an inner cap surface and an inner peripheral wall,  
comprising:  
10 means for forming a seal between the cap and an upper edge of a rim of a  
structure to which the cap is to be sealed, said seal forming means extending from  
the inner cap surface;  
said seal forming means including an inner edge and an outer edge;  
said seal forming means arranged concentric with respect to said inner  
15 peripheral wall so as to form a gap between said outer edge and said inner  
peripheral wall for receiving the upper edge of the rim;  
said inner peripheral wall including an annular ridge protruding toward a  
center of the cap and extending parallel to and spaced from said inner cap surface;  
said inner peripheral wall including a flat section extending between said  
20 inner cap surface and said ridge, said flat section being substantially the same height  
as the seal forming means.

17. The cap of claim 16, wherein the structure is one of a vial and a spout for a  
25 container.

18. The cap of claim 16, wherein the annular seal includes a truncated top  
surface.

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19. A resealable cap, comprising:

a flange integrally connecting said cap to a structure onto which the cap is to be seated;

5 said flange being formed from a flexible material so as to permit bending of the flange so that the cap can move from a first position wherein it is seated on the structure to a second position wherein it is not seated on the structure;

means on said flange for weakening said flange at a first portion in order to encourage bending of the flange at the first portion; and

10 means on said flange, adjacent to said weakening means, for stiffening said flange at a second portion to minimize bending of said flange at the second portion.

20. The cap of claim 19, wherein the weakening means is a recess formed in said flange.

15

21. The cap of claim 20, wherein the recess extends in a direction perpendicular to a longitudinal axis of said flange.

20

22. The cap of claim 19, wherein the stiffening means is a ridge formed on said flange.

25 23. The cap of claim 22, wherein the ridge extends in a direction perpendicular to a longitudinal axis of said flange.

30 24. The cap of claim 19, wherein the weakening means is located on said flange between said stiffening means and said cap.

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25. The cap of claim 19, wherein the structure is one of a spout for a container and a vial.

26. A resealable cap having an inner cap surface and an inner peripheral wall,  
5 comprising:

means for forming a seal between the cap and an upper edge of a rim of a structure to which the cap is to be sealed, said seal forming means extending from the inner cap surface;

said seal forming means including an inner edge and an outer edge;

10 said seal forming means arranged concentric with respect to said inner peripheral wall so as to form a gap between said outer edge and said inner peripheral wall for receiving the upper edge of the rim;

both the inner edge and the outer edge of said seal forming means extend toward the inner cap surface at an angle between 30 and 60 degrees;

15 a flange integrally connecting said cap to the structure;

said flange being formed from a flexible material so as to permit bending of the flange so that the cap can move from a first position wherein it is seated on the structure to a second position wherein it is not seated on the structure;

20 means on said flange for weakening said flange at a first portion in order to encourage bending of the flange at the first portion; and

means on said flange, adjacent to said weakening means, for stiffening said flange at a second portion to minimize bending of said flange at the second portion;

said inner peripheral wall including a first section and a second section,

25 said first section opposes the outer edge of the seal forming means to form the gap,

said first section is substantially the same height as the seal forming means, and

said first section extends substantially perpendicular to the inner cap surface.

30



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27. A seal arrangement for sealing a resealable cap having an inner cap surface and an inner peripheral wall onto a rim having an upper edge, comprising:

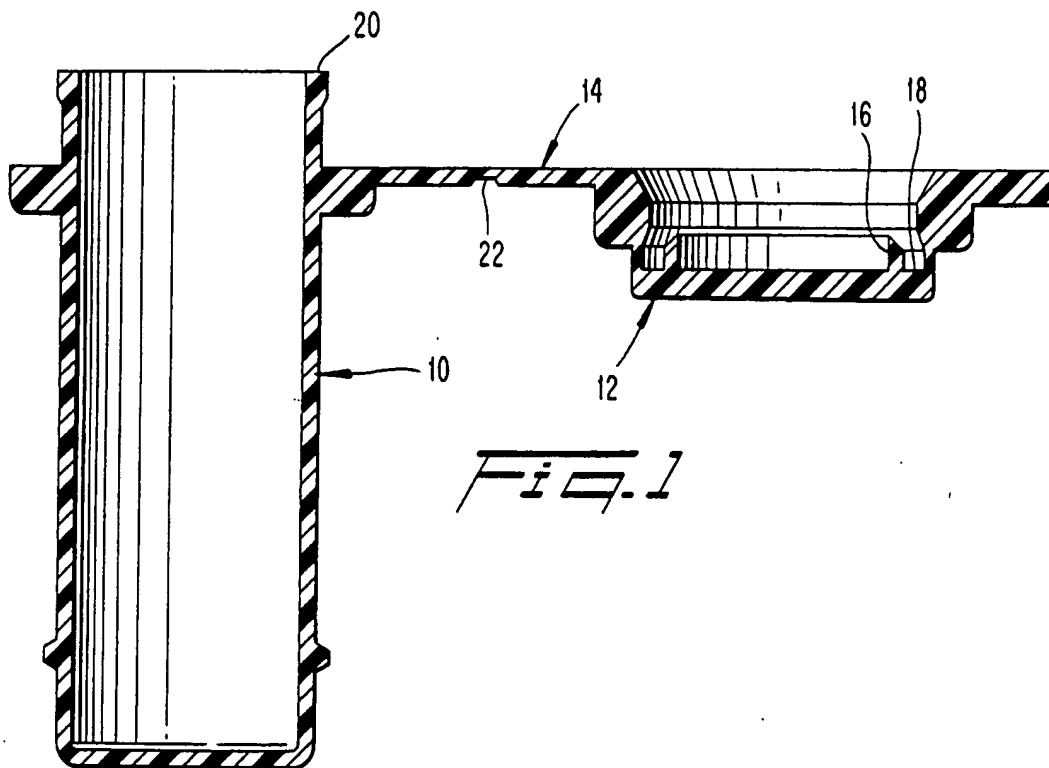
an annular seal extending from the inner cap surface;

said annular seal including a base, an inner edge, and an outer edge;

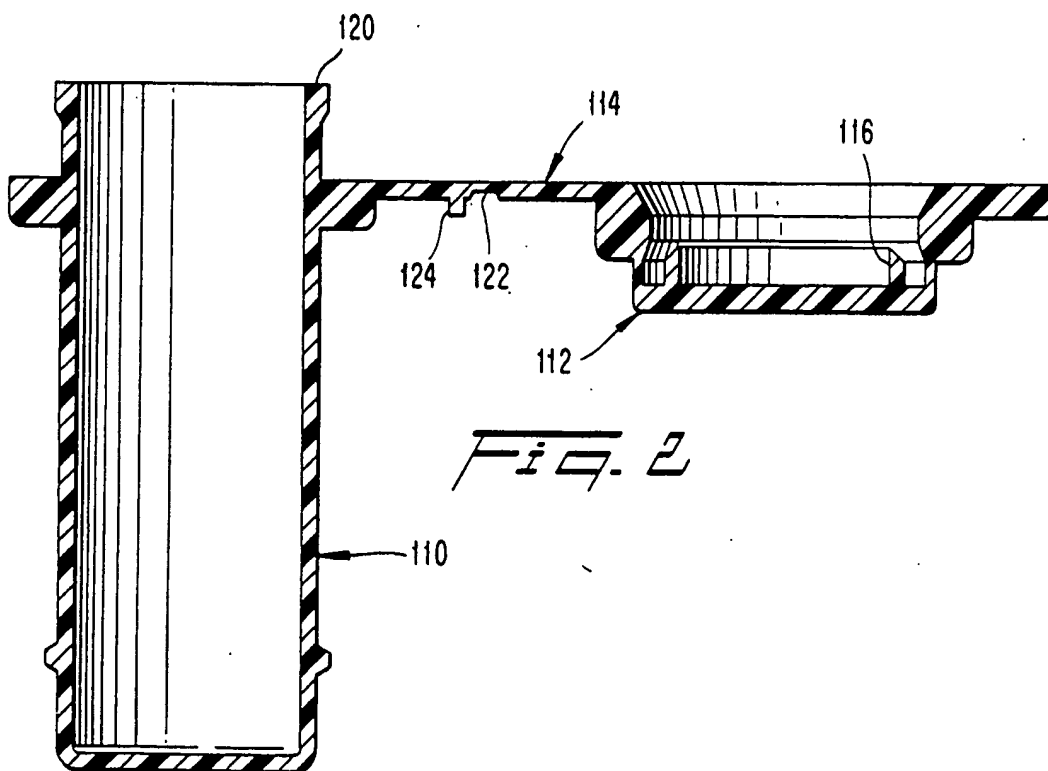
5       said annular seal arranged concentric with respect to said inner peripheral wall so as to form a gap between said outer edge of said seal and said inner peripheral wall for receiving the upper edge of the rim;

a width of the base of said seal being at least twice a height of said seal.

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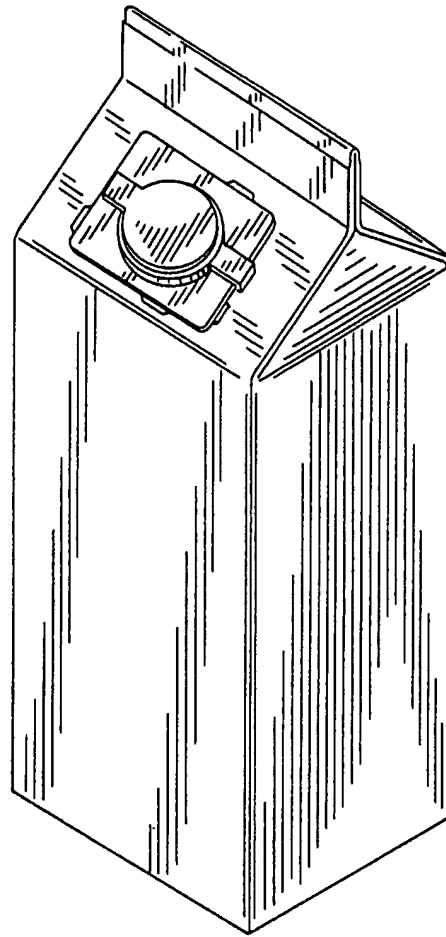


*Fig. 1*



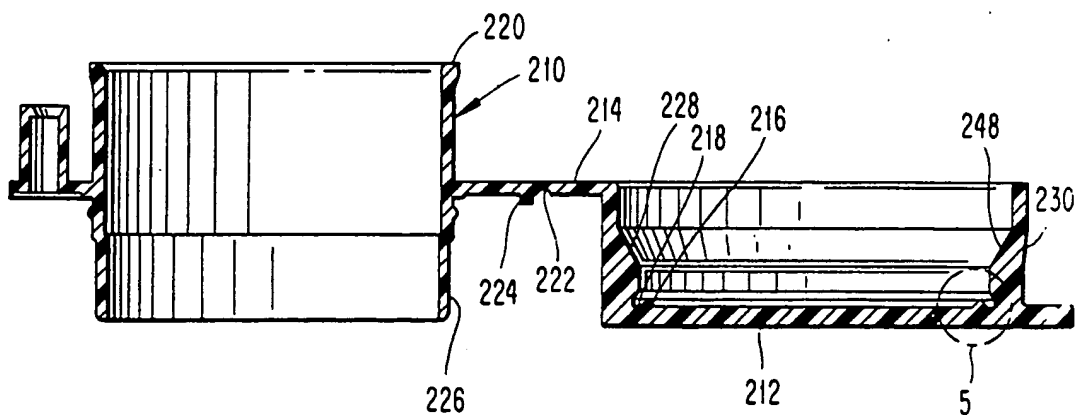
*Fig. 2*

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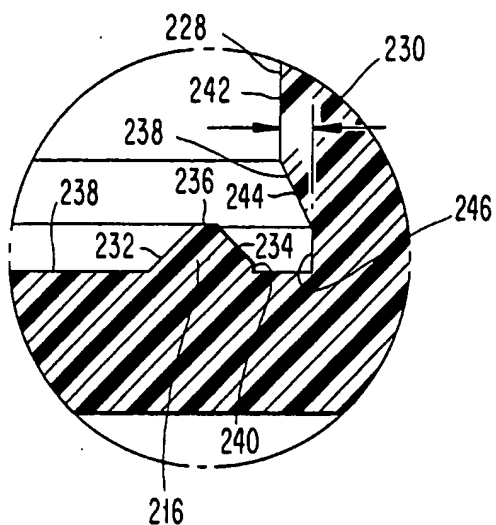
*Fig. 3*

*Fig. 4*

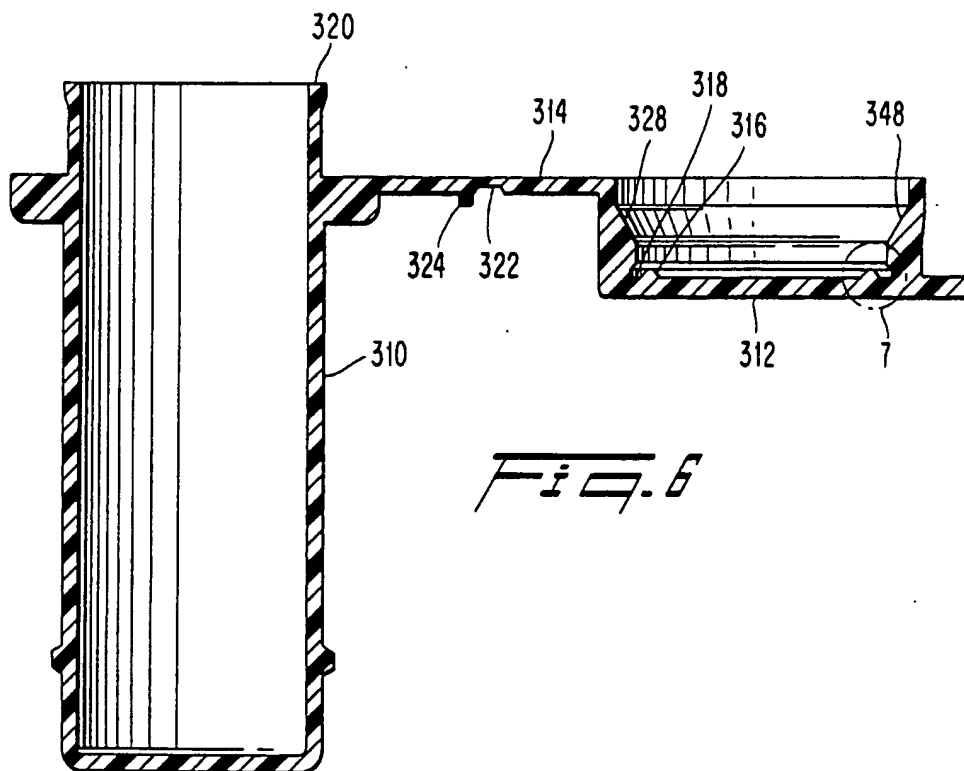
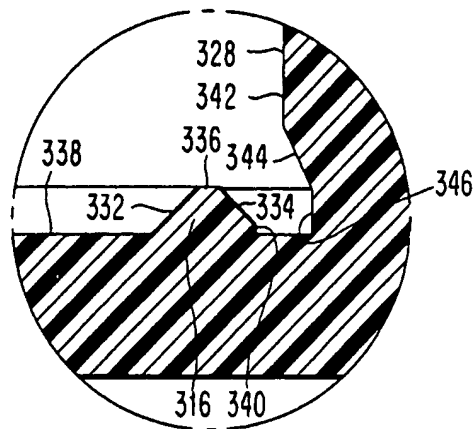


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*Fig. 5*



*Fig. 7*



*Fig. 6*

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US93/12490

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B65D 5/74  
US CL :220/306, 339

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US, A, 5,199,635 (ABRAMS ET AL.) 06 April 1993	1-27
Y	US, A, 5,108,029 (ABRAMS ET AL.) 28 April 1992	1-2
A	US, A, 4,635,823 (STULL) 13 January 1987	1
A	US, A, 4,420,089 (WALKER ET AL.) 13 December 1983	1

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Date of the actual completion of the international search

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Date of mailing of the international search report

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Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231Authorized Officer  
*Joseph Moy*  
JOSEPH MOY

Facsimile No. (703) 305-3230

Telephone No. (703) 308-0608